

Collection 6 Updates to the MODIS Cloud Mask (MOD35)

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Use of NDVI background maps

High spatial resolution 5 year means of 16-day NDVIs (Moody, et al.)

Define “desert” processing path (NDVI background < 0.3)

Define bands 1, 8 cloud test thresholds as functions of scattering angle and NDVI background; use band 8 ($0.413 \mu\text{m}$) for NDVI < 0.25

Define GEMI test thresholds as function of NDVI background in three ranges; use GEMI test for desert processing path only

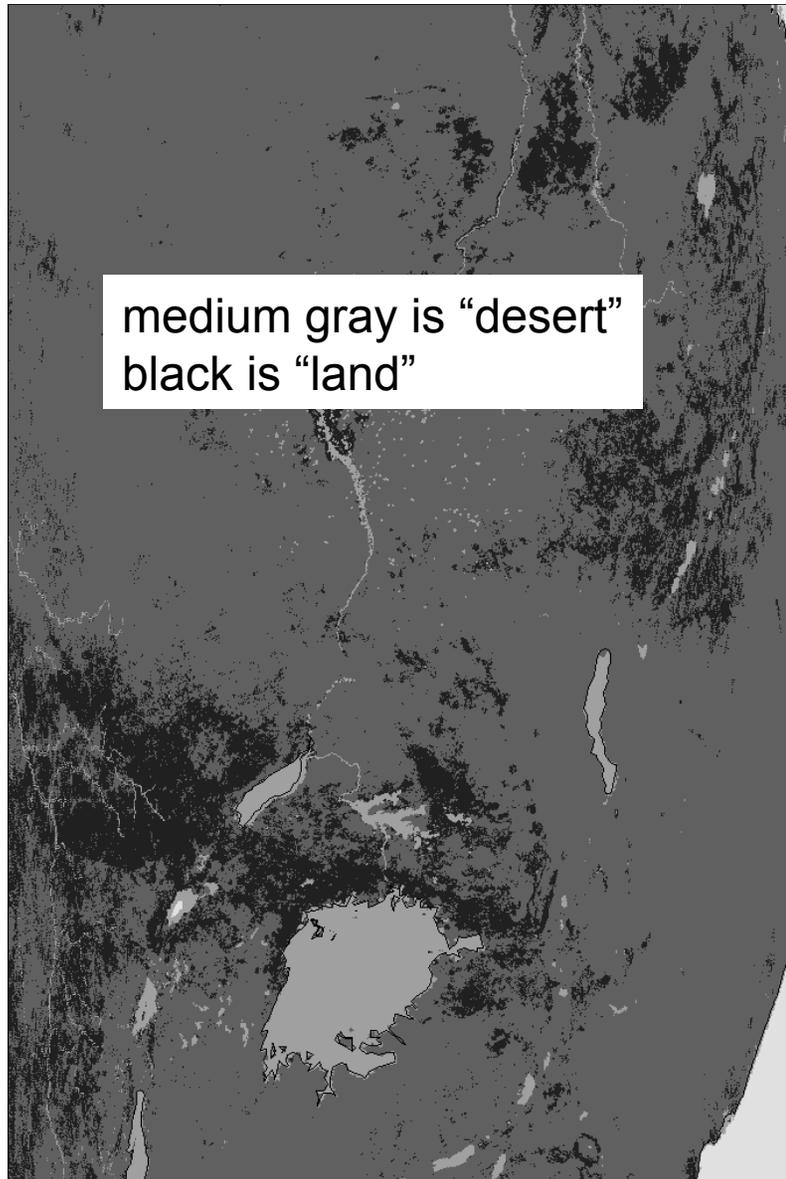
Impacts:

greatly reduces the fraction of pixels processed as “desert”

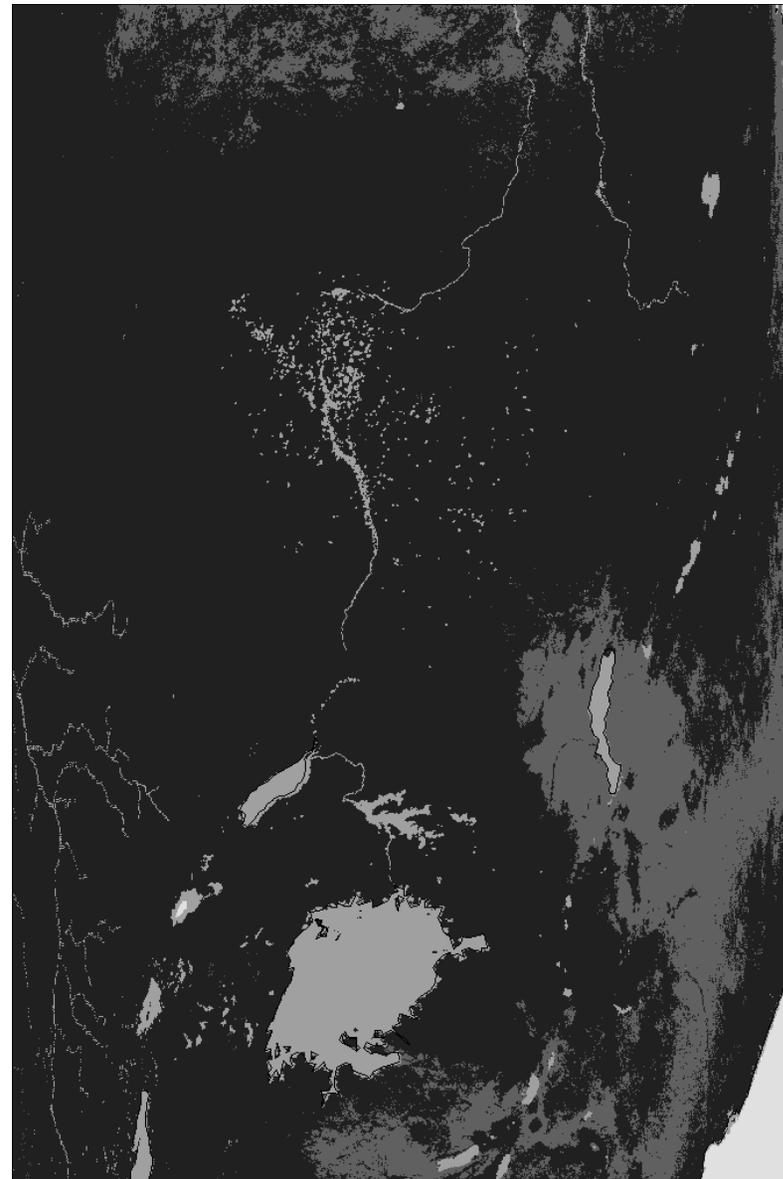
reduces the frequency of clear-sky restorals (cloudy \rightarrow clear); however, this means more “probably clear” results in very arid regions when conditions are actually clear; *users should consider both “confident clear” and “probably clear” to be clear*

decreases numbers of “probably cloudy” and “probably clear” results in vegetated regions under conditions of clear skies;

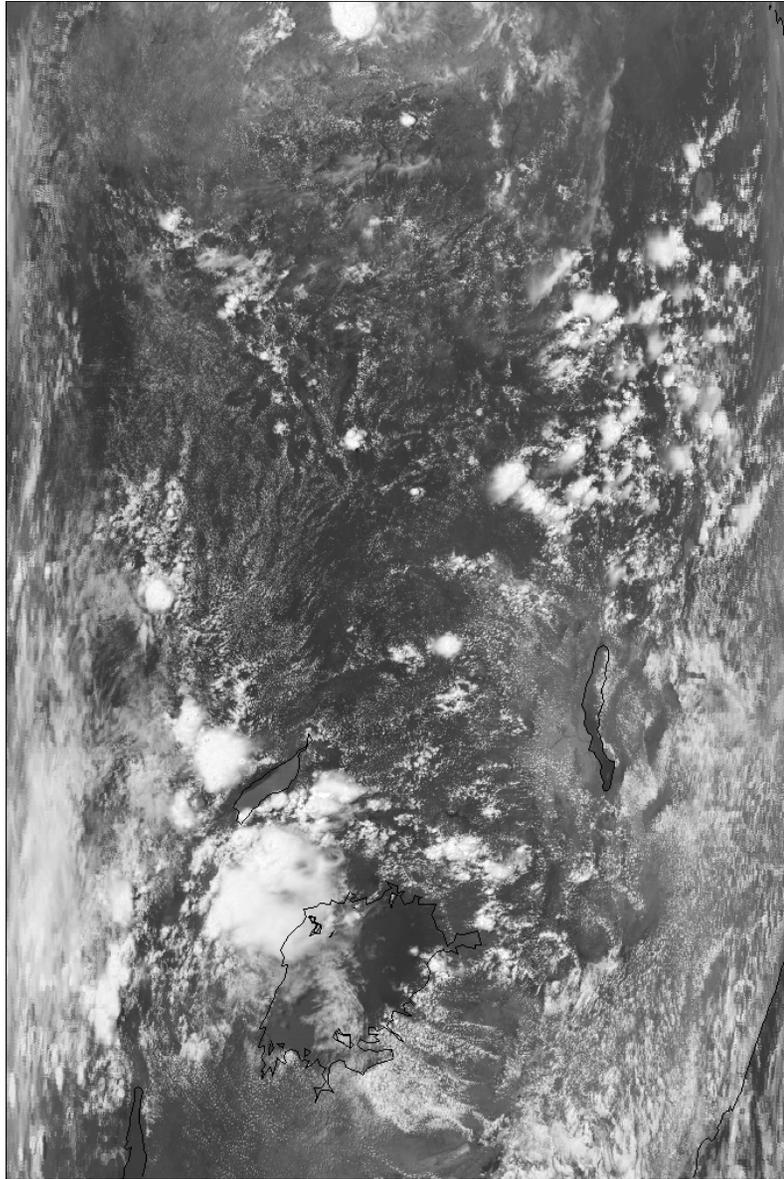
MOD35 Processing Path



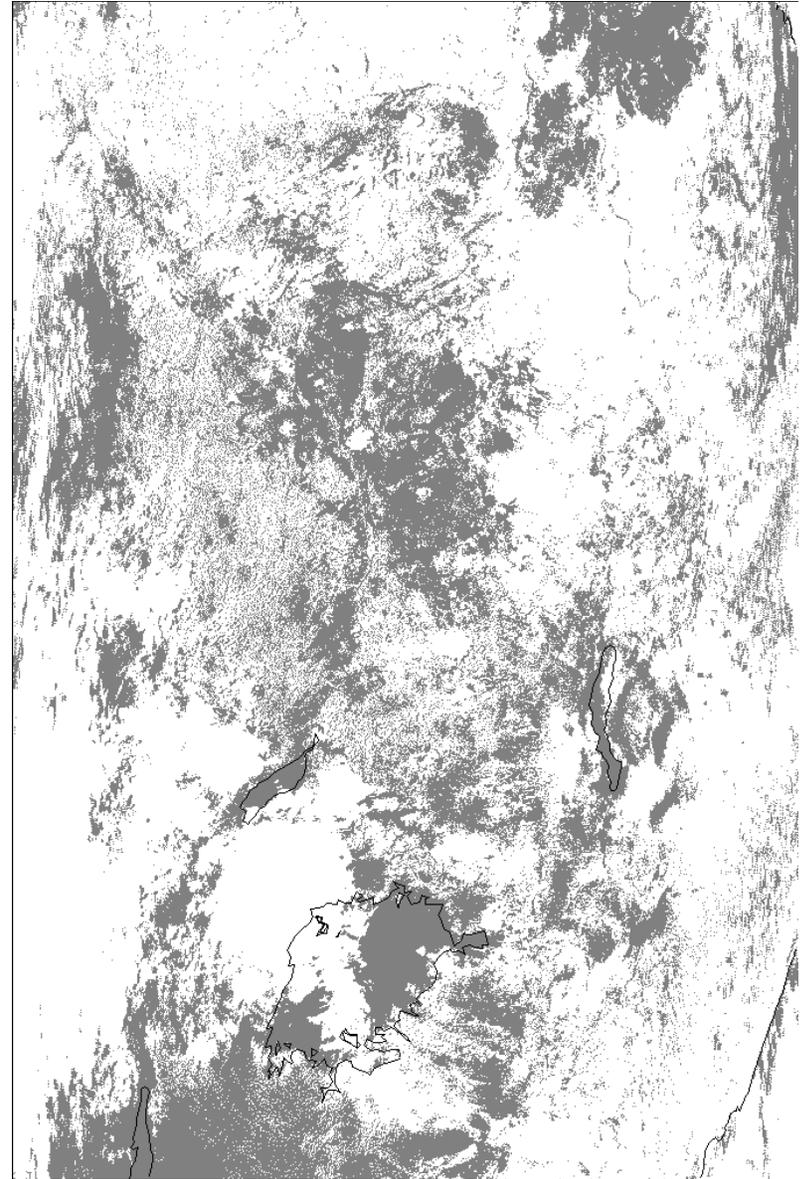
Collection 5



Collection 6

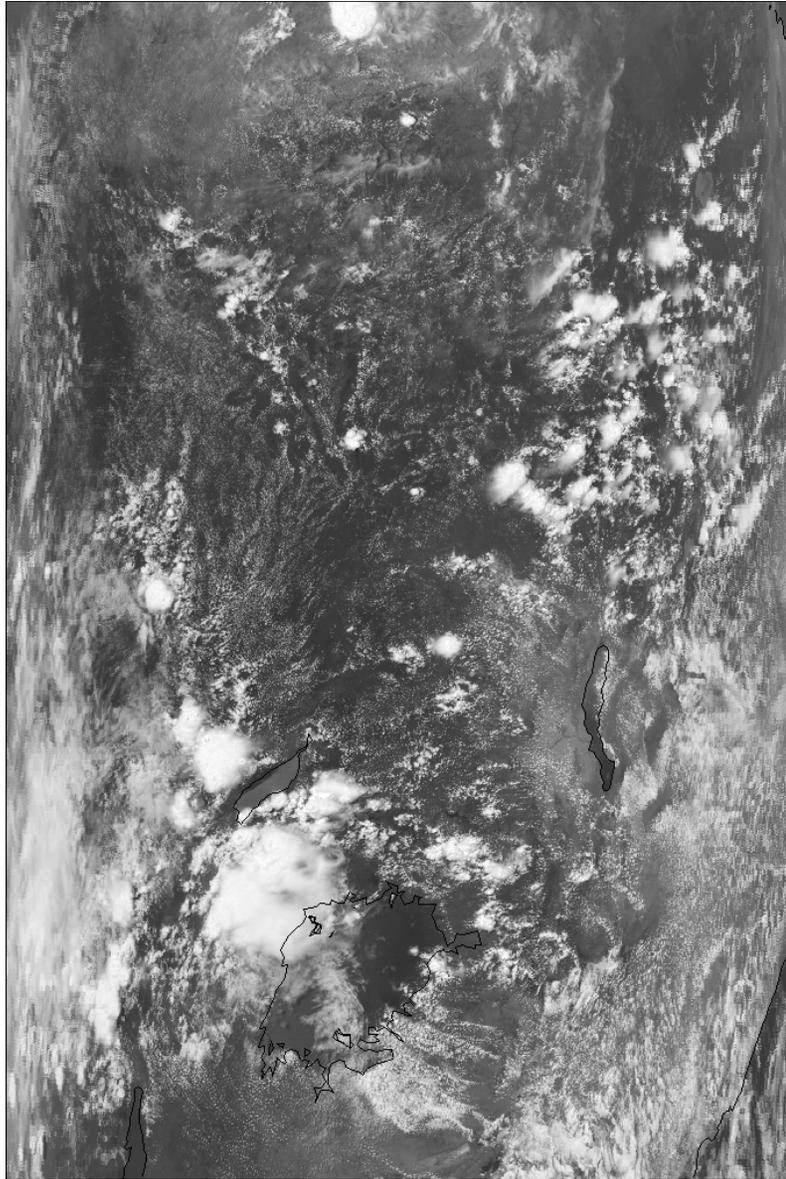


MODIS Band 1

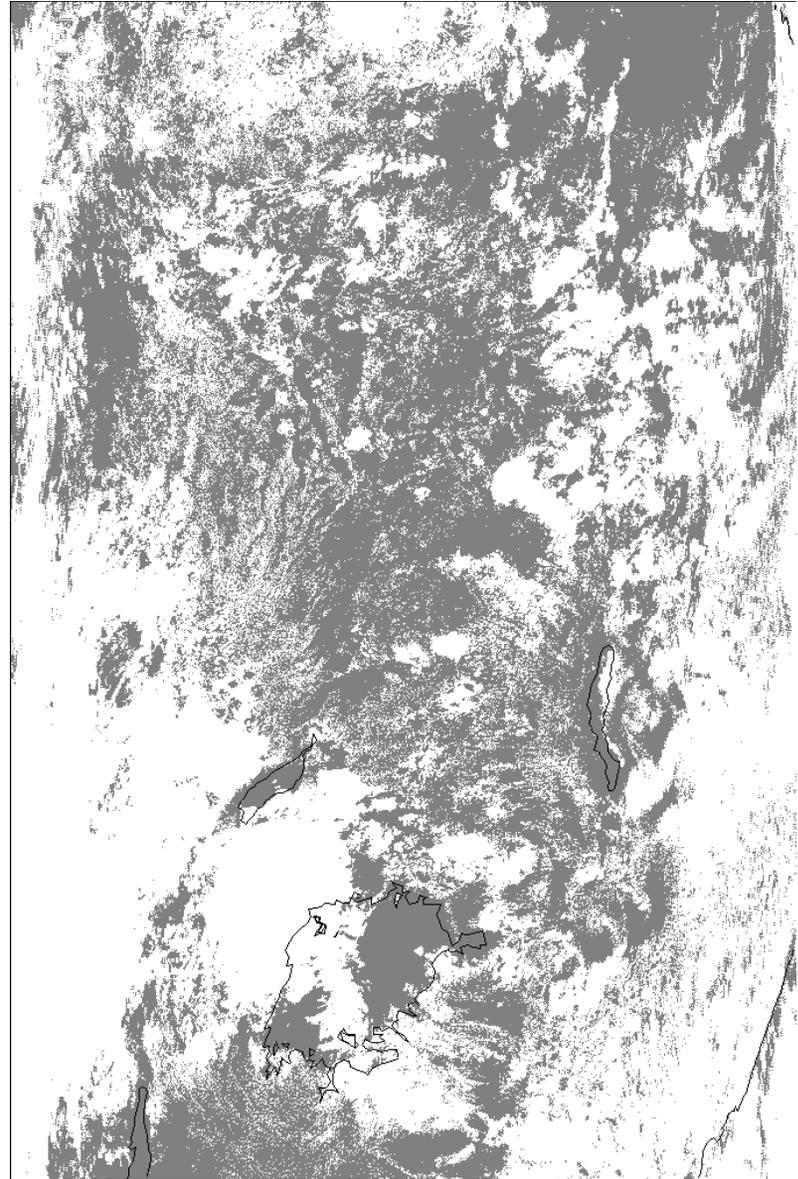


Collection 5 Visible Cloud Test

Aqua MODIS 2006240 at 11:20 UTC

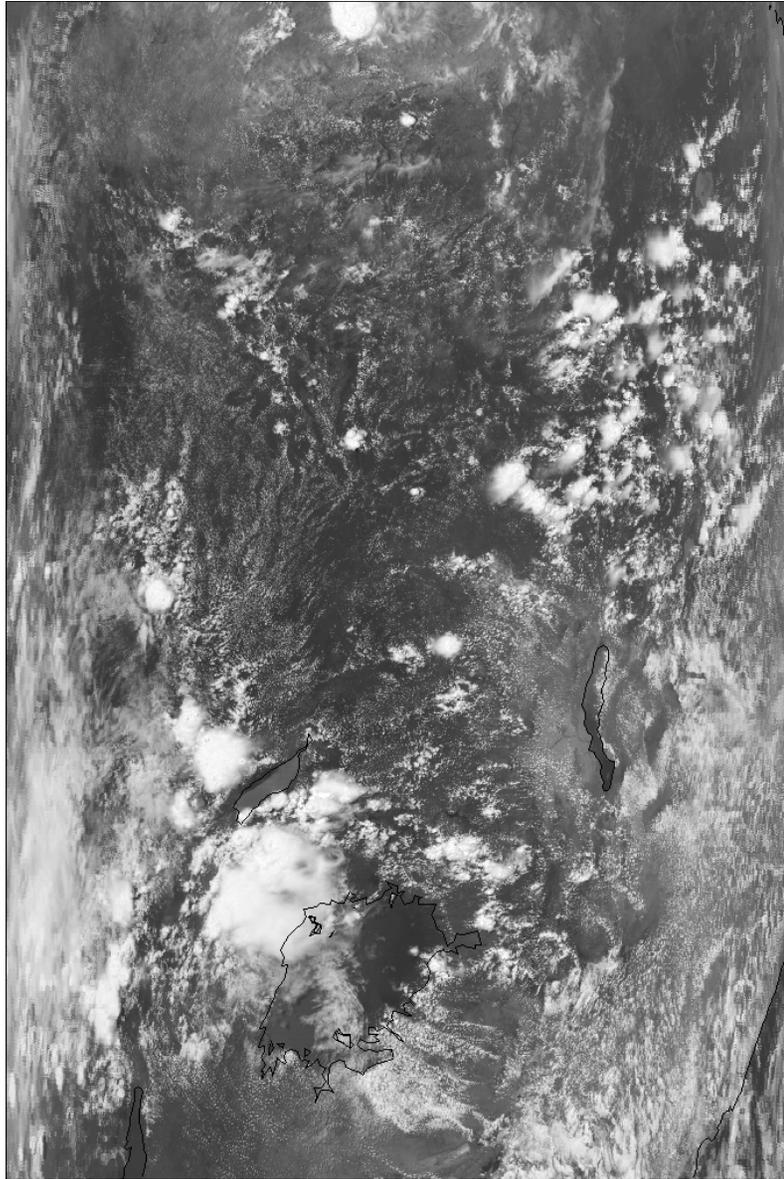


MODIS Band 1

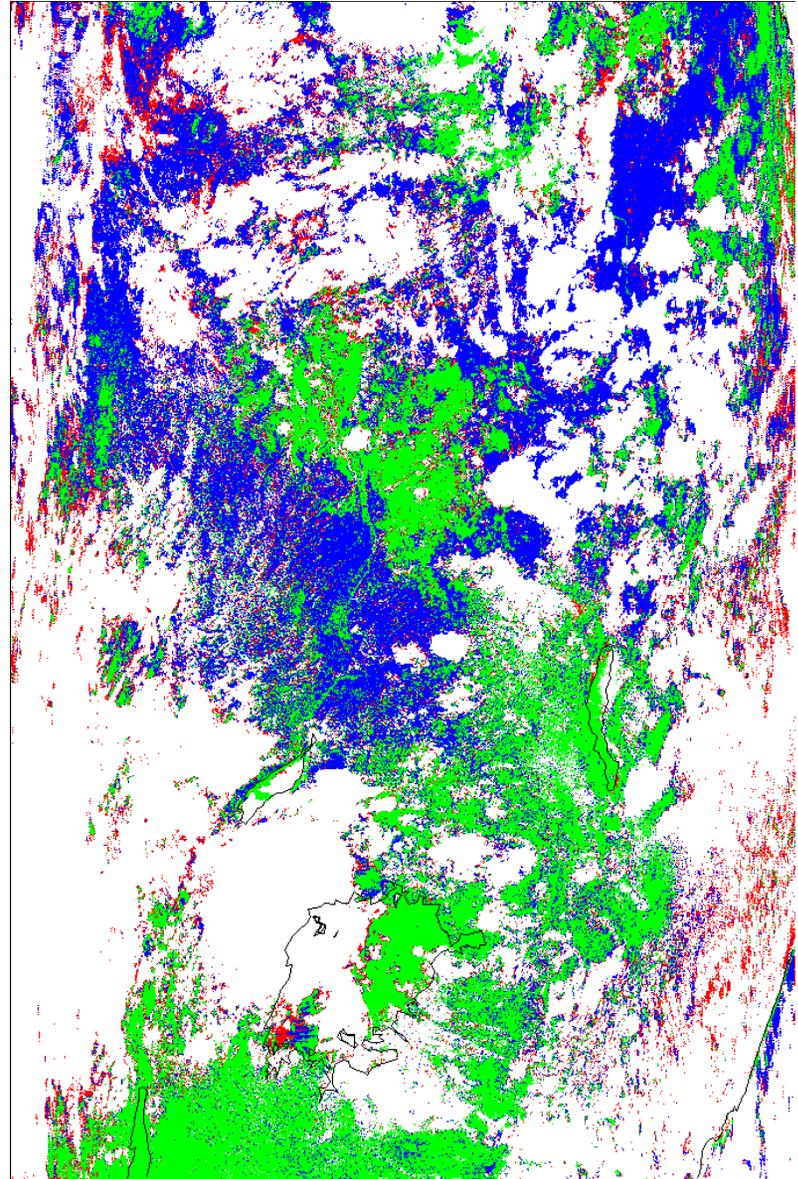


Collection 6 Visible Cloud Test

Aqua MODIS 2006240 at 11:20 UTC

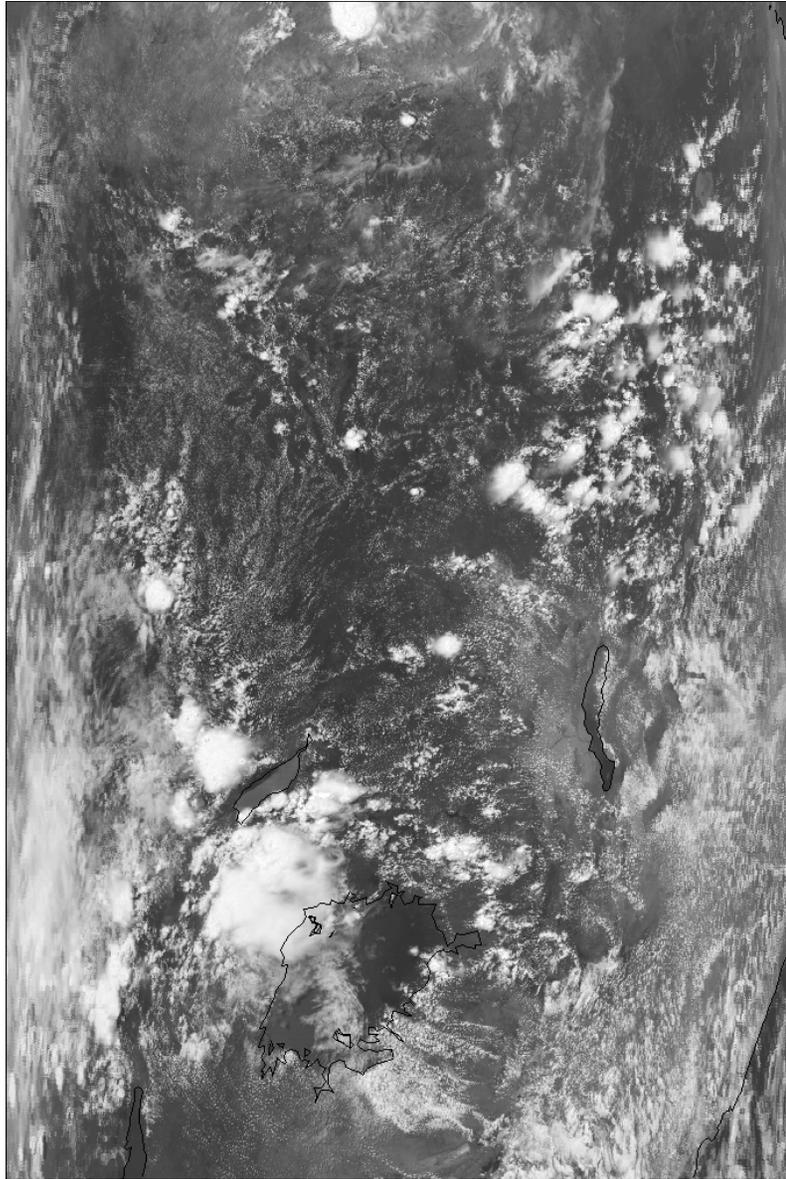


MODIS Band 1

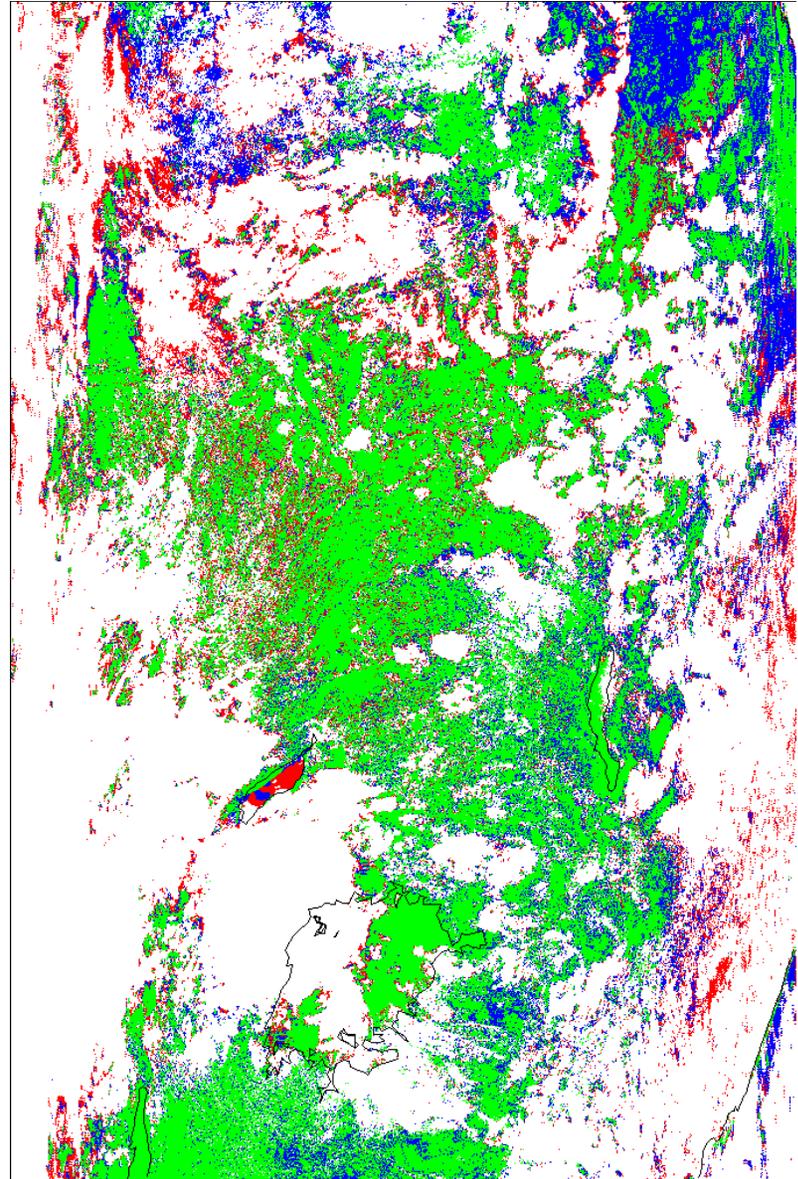


Collection 5 Cloud Mask

Aqua MODIS 2006240 at 11:20 UTC



MODIS Band 1



Collection 6 Cloud Mask

Aqua MODIS 2006240 at 11:20 UTC

MOD35 Clear-sky Restoral Tests

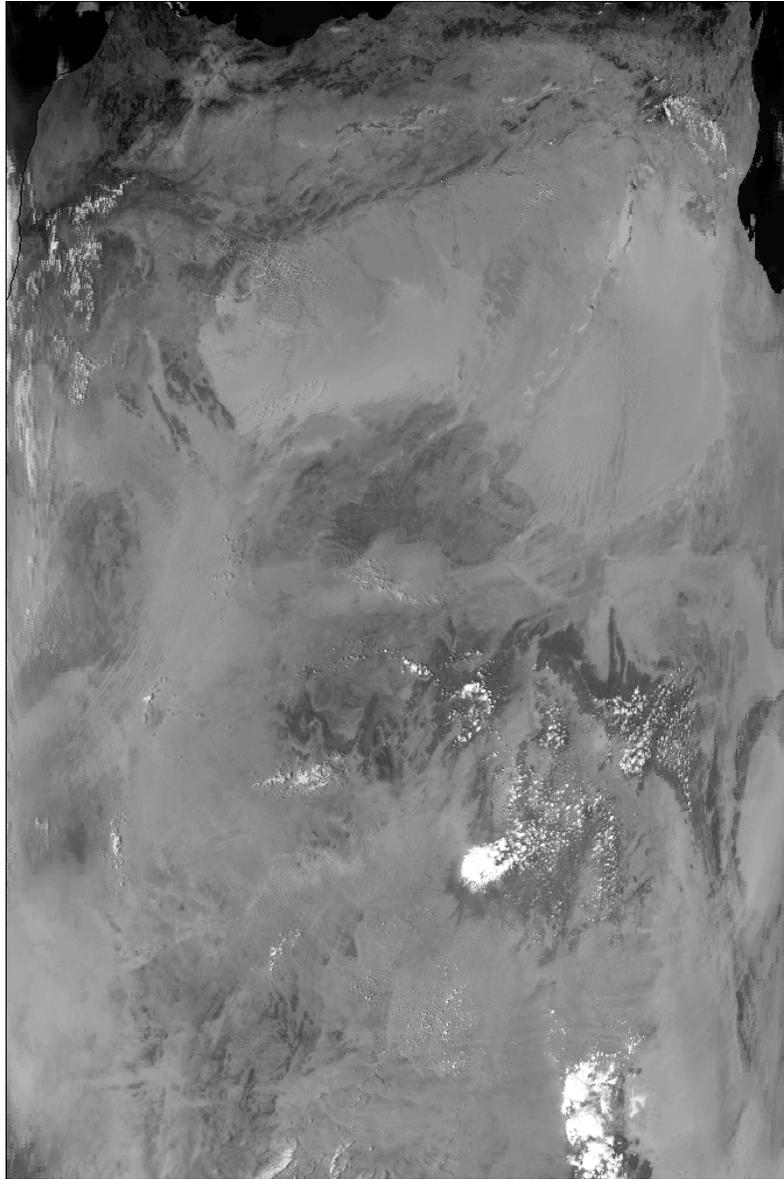


Collection 5



Collection 6

Aqua MODIS 2006240 at 13:05 UTC

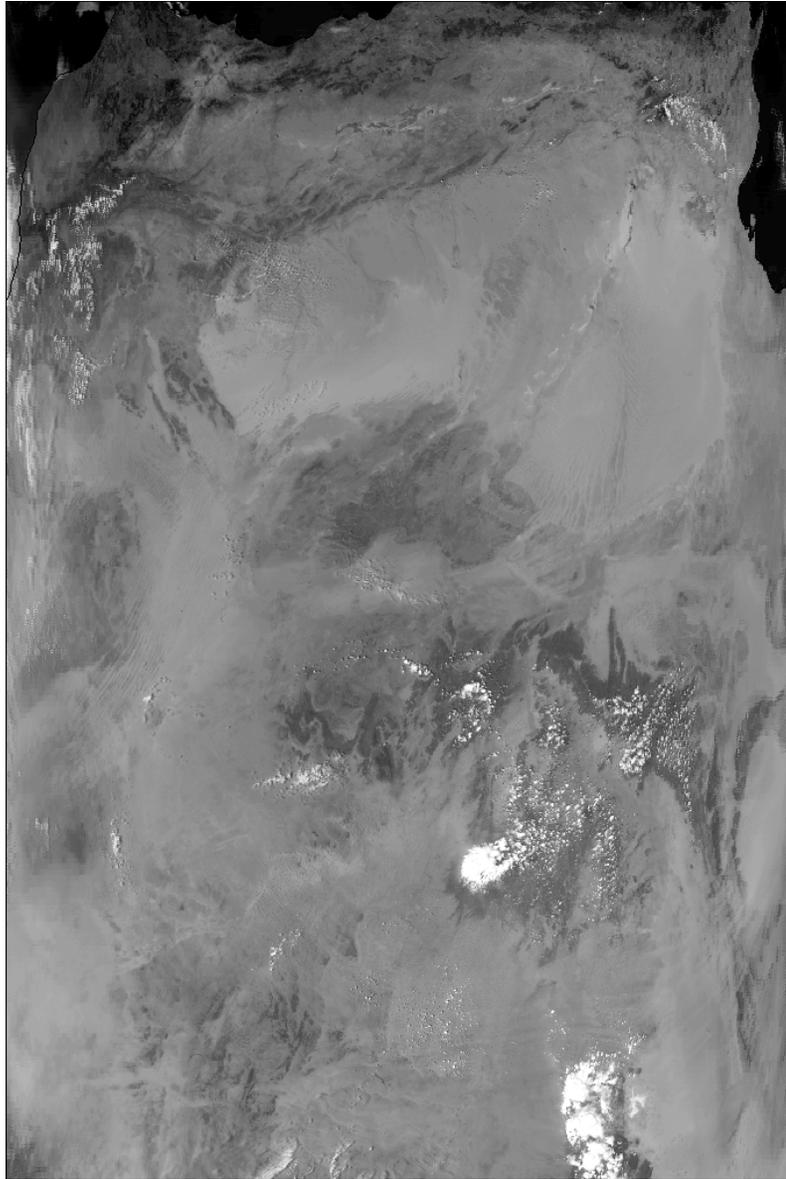


MODIS Band 1

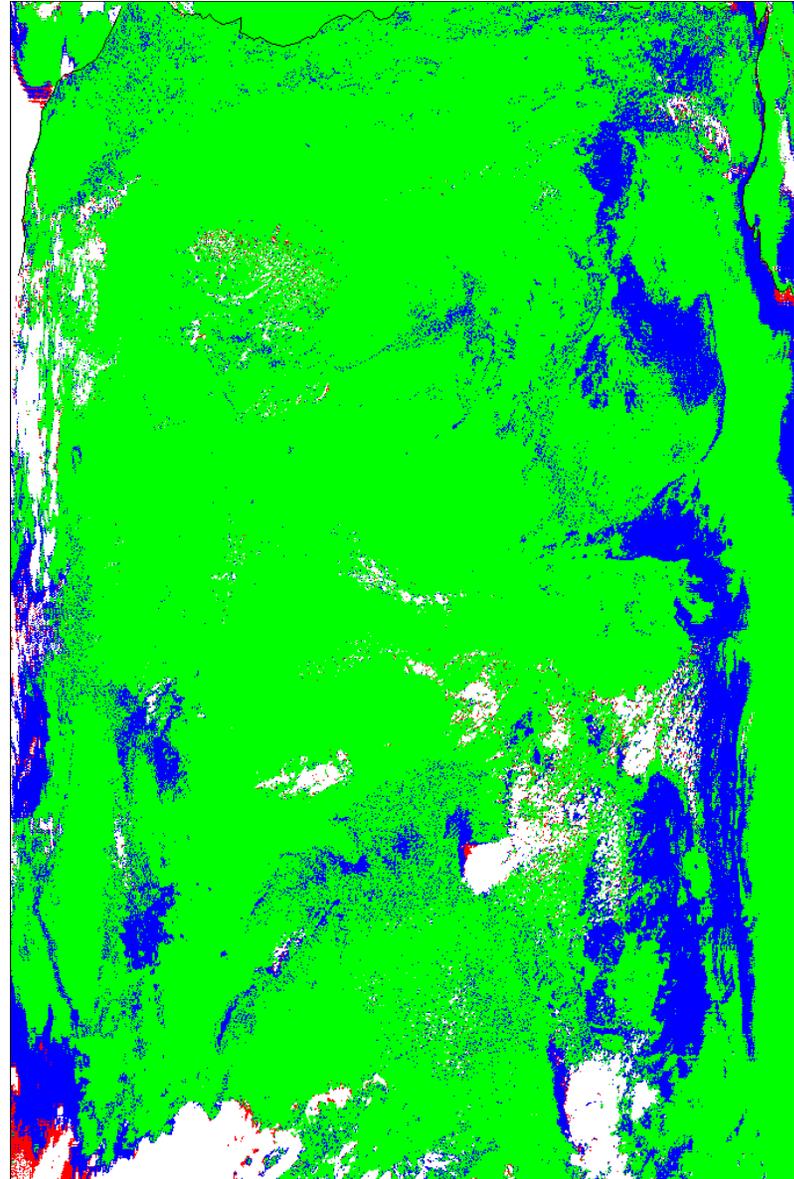


Collection 5 Cloud Mask

Aqua MODIS 2006240 at 13:05 UTC



MODIS Band 1



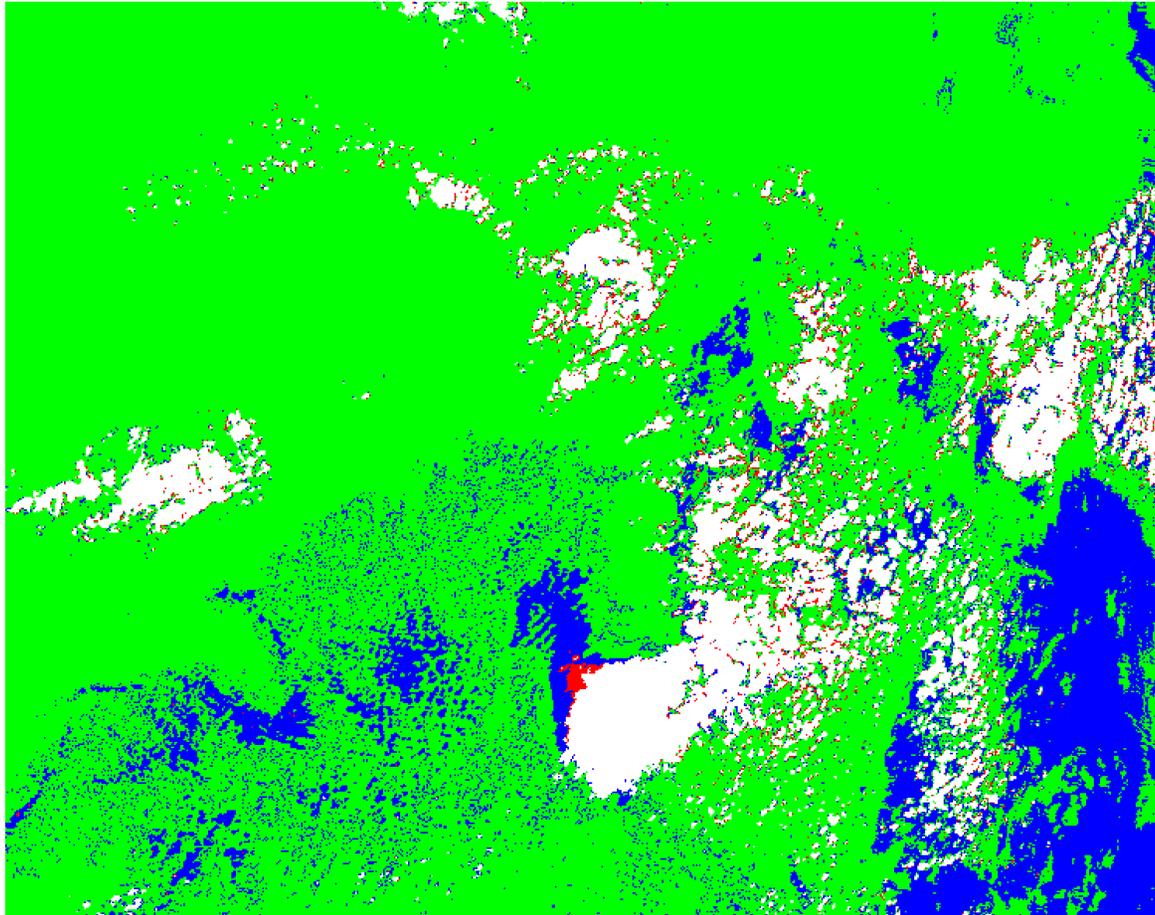
Collection 6 Cloud Mask

Aqua MODIS 2006240 at 13:05 UTC

Added cloud adjacency flag

includes probably cloudy, cloudy, and adjacent pixels

MODIS Collection 6 Cloud Mask



Aqua MODIS 2006240 at 13:05 UTC

cloud mask bit #11 ...

may be used as a “cloudy plus probably cloudy plus adjacent pixel mask”

MOD35 Collection 6 Cloud Adjacency Flag



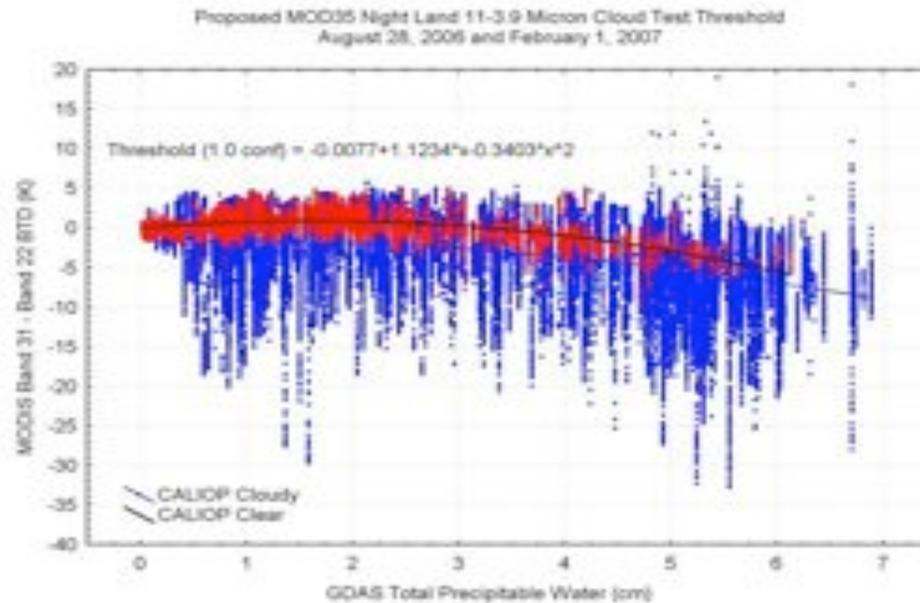
Aqua MODIS 2006240 at 13:05 UTC

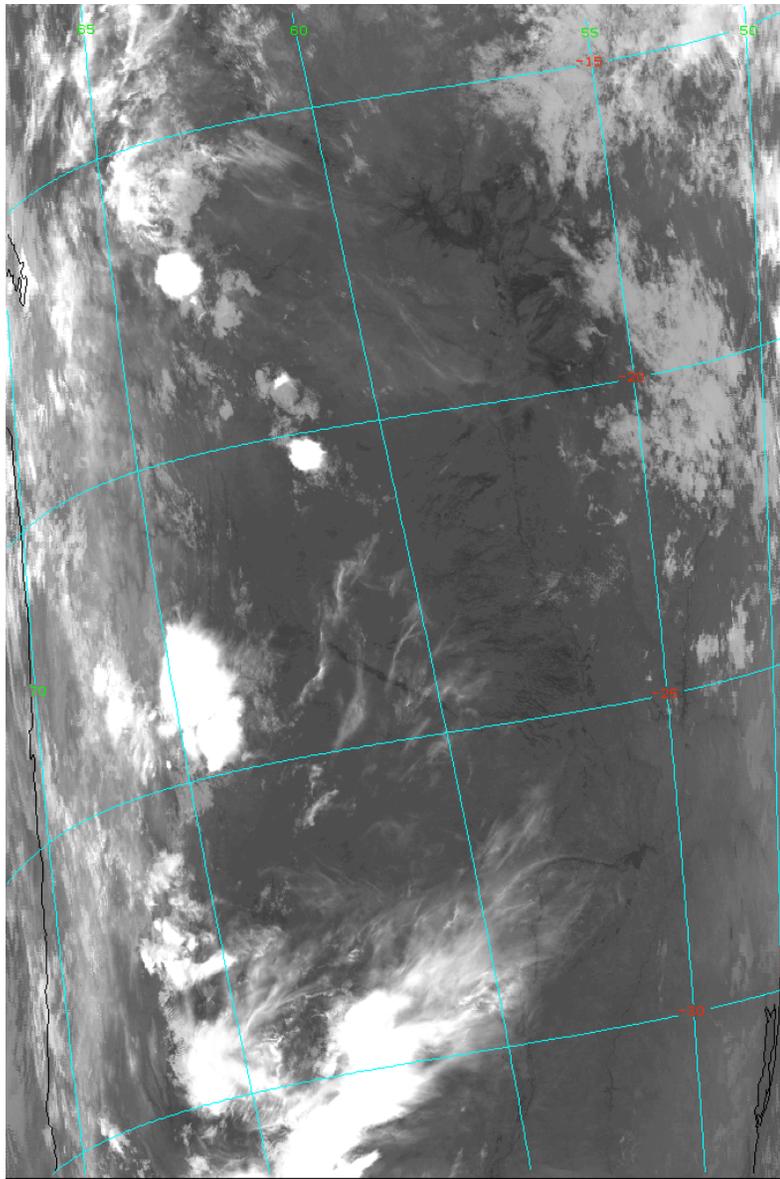
Made land night 11-3.9 μm BTD test thresholds a function of total precipitable water

Thresholds are from regression between MODIS BTDs and GDAS TPW, using CALIOP to define clear pixels

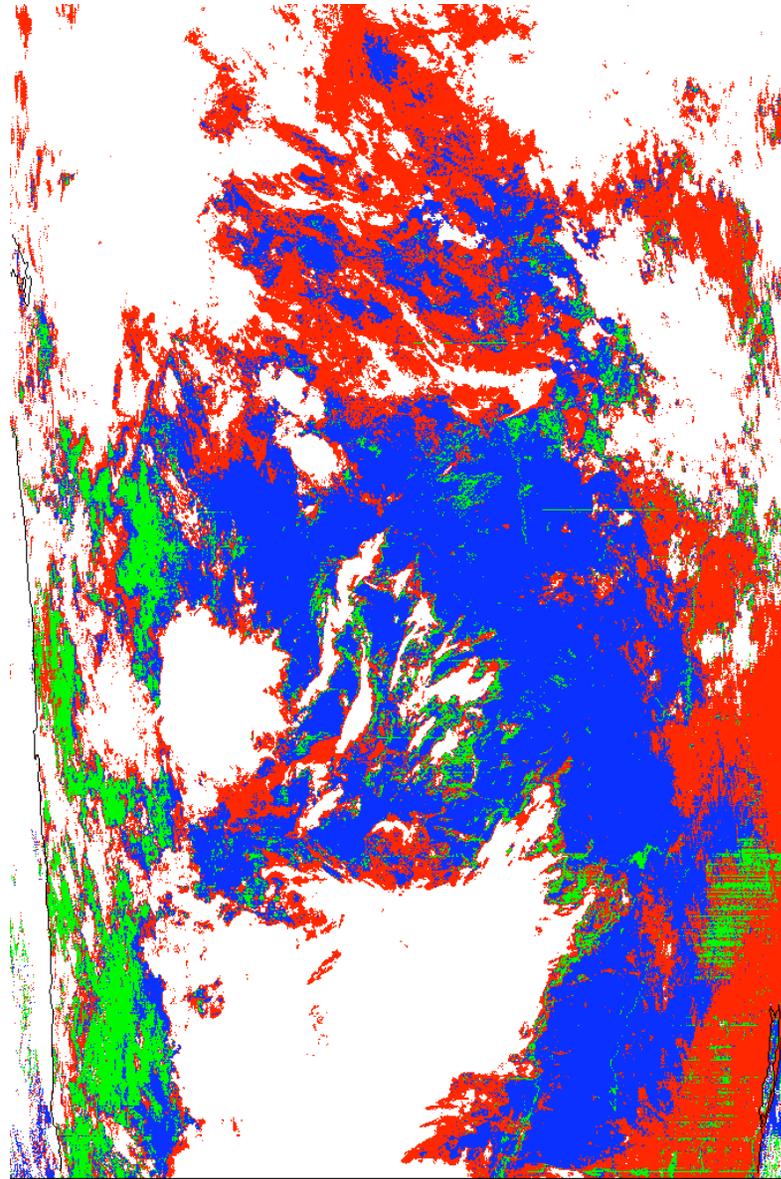
Impacts:

- Reduces number of “probably cloudy” results in clear sky conditions especially in humid tropical locations such as the Amazon Basin
- Enhances detection of transmissive cirrus



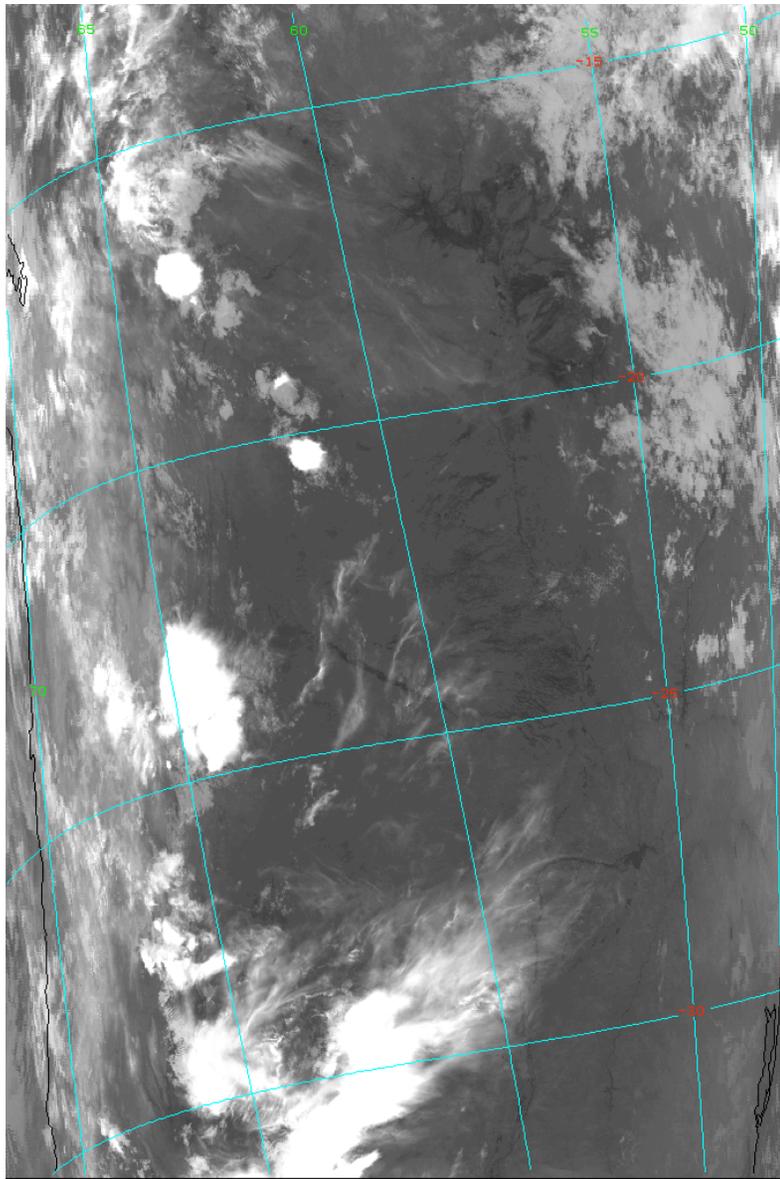


MODIS Band 20

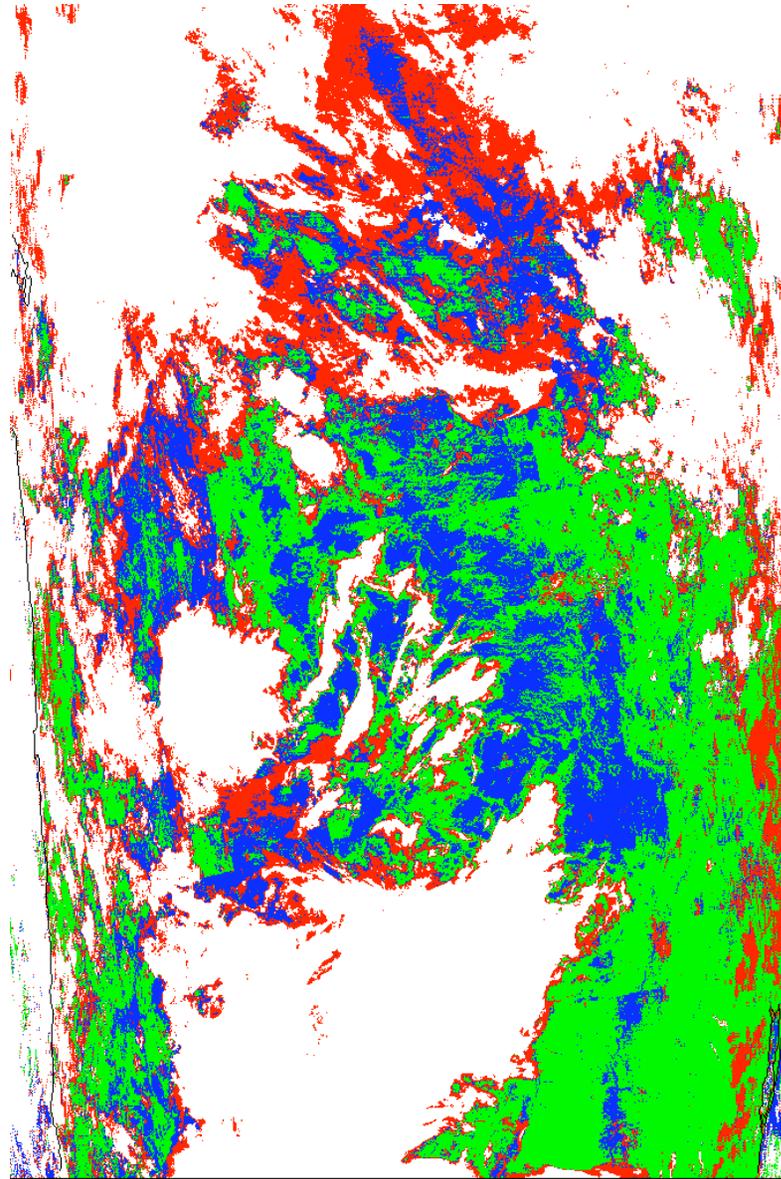


Collection 5 Cloud Mask

Aqua MODIS 2008049 at 05:20 UTC



MODIS Band 20



Collection 6 Cloud Mask

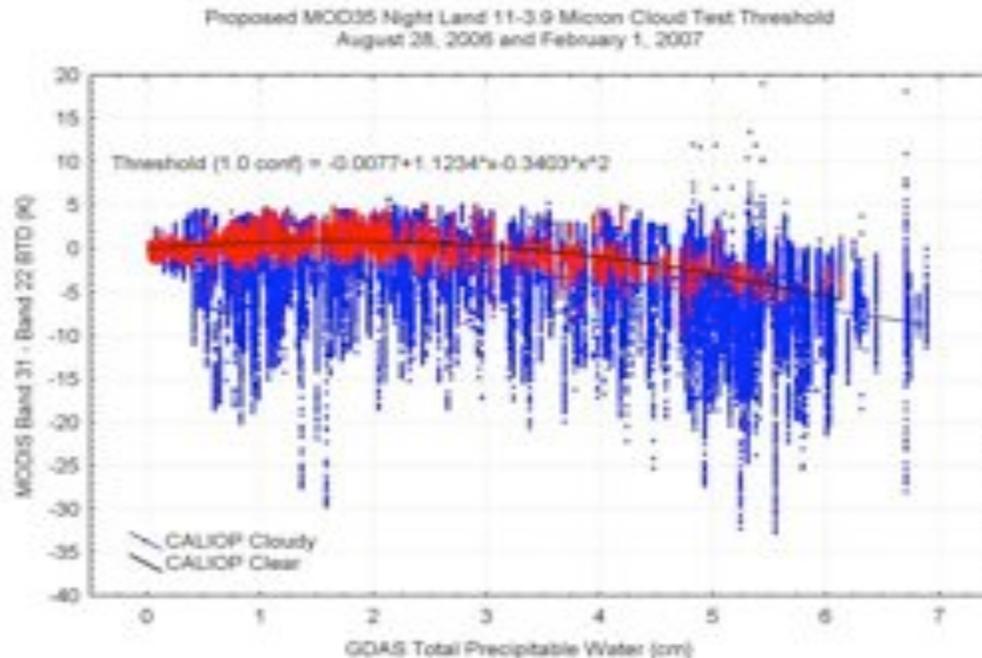
Aqua MODIS 2008049 at 05:20 UTC

Added night ocean 11-3.9 μm BTD test

Thresholds are from regression between MODIS BTDs and GDAS TPW, using CALIOP to define clear pixels

Impacts:

More clouds detected with new test as opposed to the old version; enhances detection of transmissive cirrus; kept old test to detect “low-emissivity” marine stratus;

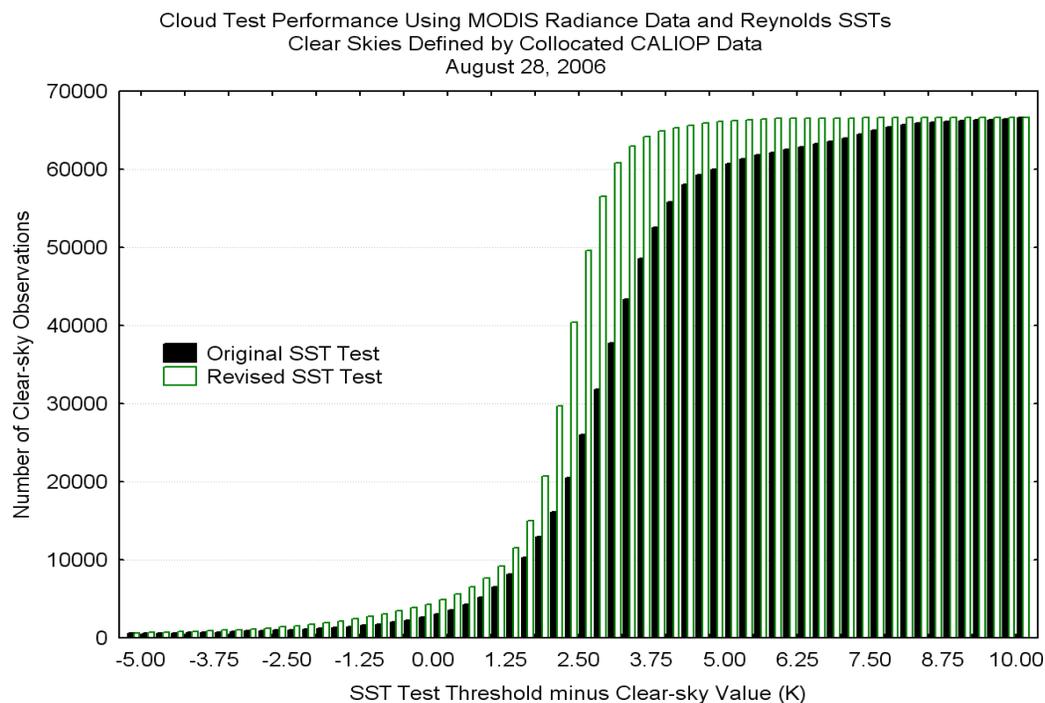


New surface temperature test for oceans

Calculates bulk SST directly from observations, tests against ancillary data value

Impact:

Better discriminates between clear skies and low clouds in moist, tropical regions such as the tropical western Pacific



Check TPW for execution of 1.38 μm test over land

Test not performed if $\text{TPW} < 0.75 \text{ cm}$

Impact:

Reduces false cloud detections due to surface reflectance in dry atmospheres

Eliminated tri-spectral test in ocean scenes; replaced with simple 8.6-11 μm BTD threshold test

Impact:

Eliminates many “probably cloudy” and “probably clear” results in clear-sky conditions, especially in moist tropical locations

Added 7.3-11 μm cloud test to daytime Antarctica and Greenland

Impact:

Detects some additional clouds in these regions

Additional tests for non-cloud obstructions

“GOES_R” dust algorithm (day, night, land, water)

Thick smoke/aerosol test for daytime water surfaces

Impact:

More optically thick non-cloud obstructions are detected

Day snow and polar day snow 3.9-11 μm algorithms merged

Impact:

Fewer false clouds in very cold atmospheres south of 60N